420178

FLOOD INSURANCE STUDY

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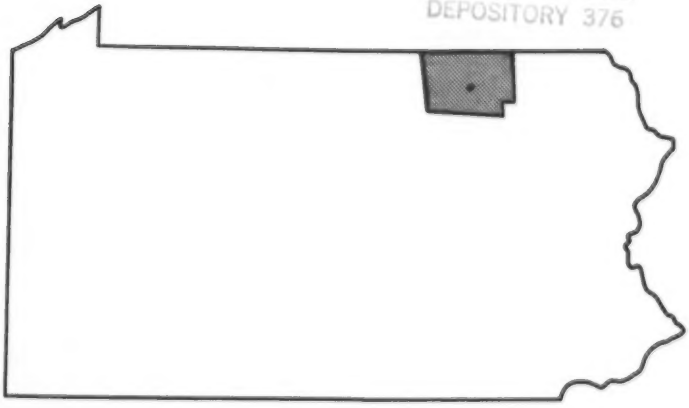
BOROUGH OF TOWANDA, PENNSYLVANIA
BRADFORD COUNTY



SEPTEMBER 16, 1980

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
BOROUGH OF TOWANDA, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Towanda, Bradford County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Towanda to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1(d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Gilbert Associates, Inc., for the Federal Insurance Administration. under Contract No. H-4557. This study was completed in March 1979.

1.3 Coordination

In June 1977, an initial Consultation and Coordination Officer's (CCO) meeting was held with members of the FIA, the Borough of Towanda, and the study contractor. The purpose of the meeting was to identify the streams to be studied by detailed and approximate methods. During the course of the study, contact was made with the United States Geological Survey (USGS), the Bradford County Planning Commission, and the Northern Tier Regional Planning and Development Commission for local flood information. The Pennsylvania Department

of Transportation and Conrail were contacted for information concerning highways and railroad bridges, respectively. A final CCO meeting attended by representatives of the FIA, the borough, and the study contractor was held on April 15, 1980, to present the results of this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Towanda, Bradford County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The Susquehanna River and Tributary A were studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through March 1984.

2.2 Community Description

The Borough of Towanda is located in the central portion of Bradford County in northeastern Pennsylvania. The borough is bordered by the Township of North Towanda to the north and is surrounded by the Township of Towanda to the east, west, and south. The borough has a total land area of 1.3 square miles. According to the U. S. Bureau of the Census, the 1970 population of 4,224 was a 1.6-percent decrease from 1960 (Reference 1).

The Borough of Towanda is located on the right bank of the Susquehanna River and has steep hills to the west. The topography of the borough is characterized by a rugged surface, with the land slope toward the east as high as 20 percent. The streets cross contour lines at a 90-degree angle and lie in the direction of the slope, with most of the street slopes being 15 percent. The most common types of land use in the borough are residential and commercial.

The borough has a continental climate and an average annual temperature of 47 to 50 degrees Fahrenheit (°F). The average summer temperature is 70°F, and the average winter temperature is 30°F. The average annual rainfall is 35 inches; the average annual snowfall varies from 30 to 70 inches, with a snow cover of an inch or more occuring approximately 70 days each year.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

APPROXIMATE SCALE
2000 0 2000 4000 6000 FEET

VICINITY MAP

2.3 Principal Flood Problems

The principal source of flooding problems within the Borough of Towanda is the Susquehanna River. Several tributaries of the Susquehanna River also cause drainage problems in the borough. Tributary A, which overflows its below grade culvert system, is the most important of these tributaries.

The steep-sloped streets and adjacent areas running west to east tend to become primary flood channels for stormwater runoff. Stormwater flooding for each of the four specified frequencies occurs along these adjacent low lying areas to Tributary A. The flood profiles for Tributary A designate the dimensions of the above mentioned culvert system along with the superimposed primary channel bed elevations to clarify the flooding situation for Tributary A. A stormwater drainage study done in 1975 found that with the exception of a few sporadic subsurface drainage facilities concentrated at the lower and middle portions of the borough where the needs are most obvious, there is no systematic storm sewer network in Towanda (Reference 2). Surface runoff within the street pavement is the rule. In addition, the vast majority of the streets are not equipped with adequate curbs and gutters to contain and control stormwater flow within such streets. A variety of serious drainage problems arise periodically in Towanda in conjunction with heavy rain. These are the obvious consequences of either non-existent or inadequate municipal drainage facilities.

The Susquehanna River caused flooding in March 1936, May 1946, June 1972, and September 1975. The recurrence intervals for the floods were 19, 16, 480, and 46 years, respectively. During the 1972 Hurricane Agnes flood, the borough's location on elevated terrain kept most of it well above the flood plain, however, surface runoff conditions were severe and streamflows were high. A narrow portion of the borough along the Susquehanna River was flooded and suffered significant damage. Substantial damage occurred to homes, businesses, and the borough hall when most of River Street and a portion of Main Street were inundated.

2.4 Flood Protection Measures

There are no existing local flood protection projects in the borough. There are a number of dams and reservoirs within the Susquehanna River basin upstream of the Borough of Towanda that provide flood protection. Upon completion of the Tioga-Hammond and Cowanesque reservoirs, the flood hazards within the borough will be further reduced.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The discharges for the Susquehanna River were adopted from the Flood Insurance Study for the Township of Wysox (Reference 3). The regulating effects of the upstream dams were taken into consideration in the hydrologic analyses. The peak discharges for Tributary A were determined using the Penn State Urban Runoff Model (Reference 4).

A summary of drainage area-peak discharge relationships is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SUSQUEHANNA RIVER					
At USGS gaging station (#01531500)	7,797.00	140,000	192,000	212,000	270,000

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TRIBUTARY A					
At the Conrail bridge	1.08	489	770	876	1,315
At the upstream entrance to the culvert series	0.87	356	564	705	945

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross sections were located at regular intervals along the stream length and at significant changes in ground relief and land use or land cover. The ground and channel bottom elevations at the cross sections were obtained by field survey. Cross sections were also taken at close intervals above and below bridges in order to compute the significant backwater effects of these structures. Tributary A contains a series of culverts and three sections of open-channel areas. During normal conditions, the culverts can adequately handle the flow. During flood conditions, however, the culverts overflow once they have reached their maximum capacities. The overflow results in overland flow in the borough. For the purpose of this Flood Insurance Study, only the overland and open-channel flows were considered in the hydraulic analyses. The overland cross sections for Tributary A were obtained from aerial maps with a contour interval of 5 feet (Reference 5).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The values chosen were compared with tables published by Ven Te Chow (Reference 6). For the Susquehanna River, the channel "n" values ranged from 0.029 to 0.035, and the overbank "n" values ranged from 0.044 to 0.080. For Tributary A, the channel "n" value was 0.050, and the overbank "n" values ranged from 0.050 to 0.070.

The backwater computations for the Susquehanna River were started at the downstream corporate limits; the starting water-surface

elevation was adopted from the Flood Insurance Study for the Township of Wysox (Reference 3). Normal water depths were used for starting elevations for the water-surface profiles of Tributary A.

The hydraulic model was tested and the "n" values were adjusted within an acceptable range by using the water-surface elevations published in the Township of Athens Flood Insurance Study (Reference 7). Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the U. S. Army Corps of Engineers (COE) HEC-2 water-surface profiles computer program (Reference 8).

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed, and dams and other flood control structures operate properly and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of

the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Reference 5). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths of the Susquehanna River extend beyond the corporate limits of the Borough of Towanda.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Tributary A								
A	130	50	558	1.3	726.7	726.7	727.7	1.0
B	610	49	116	6.3	746.1	746.1	746.3	0.2
C	1,310	71	100	6.6	766.5	766.5	766.5	0.0
D	1,775	97	971	0.8	793.0	793.0	793.9	0.9
E	2,220	53	61	6.1	812.4	812.4	813.3	0.9
F	2,850	67	92	4.1	835.6	835.6	836.4	0.8
G	3,270	68	433	1.6	850.1	850.1	850.5	0.4

[1] Feet above confluence with Susquehanna River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

FLOODWAY DATA

TRIBUTARY A

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Susquehanna River								
A	900	1,511	35,422	6.0	719.9	719.9	720.8	0.9
B	1,750	1,112	29,925	7.1	720.4	720.4	721.2	0.8
C	2,720	861	26,521	8.0	720.9	720.9	721.8	0.9
D	3,035	1,080	33,275	6.4	721.3	721.3	722.3	1.0
E	3,710	1,263	34,698	6.1	721.7	721.7	722.7	1.0
F	4,210	1,369	37,546	5.6	721.8	721.8	722.8	1.0
G	5,660	1,517	38,986	5.4	722.0	722.0	723.0	1.0
H	6,660	1,268	31,920	6.6	722.0	722.0	723.0	1.0
I	7,585	1,204	30,438	7.0	722.1	722.1	723.1	1.0
J	8,460	1,281	30,004	7.1	722.4	722.4	723.2	0.8
K	9,210	972	22,347	9.5	722.4	722.4	723.2	0.8
L	9,785	998	22,358	9.5	722.4	722.4	723.2	0.8
M	10,235	977	23,159	9.2	722.7	722.7	723.4	0.7
N	10,910	985	23,383	9.1	722.9	722.9	723.6	0.7

[1] Feet above corporate limits
[2] This width extends beyond corporate limits

TABLE 2

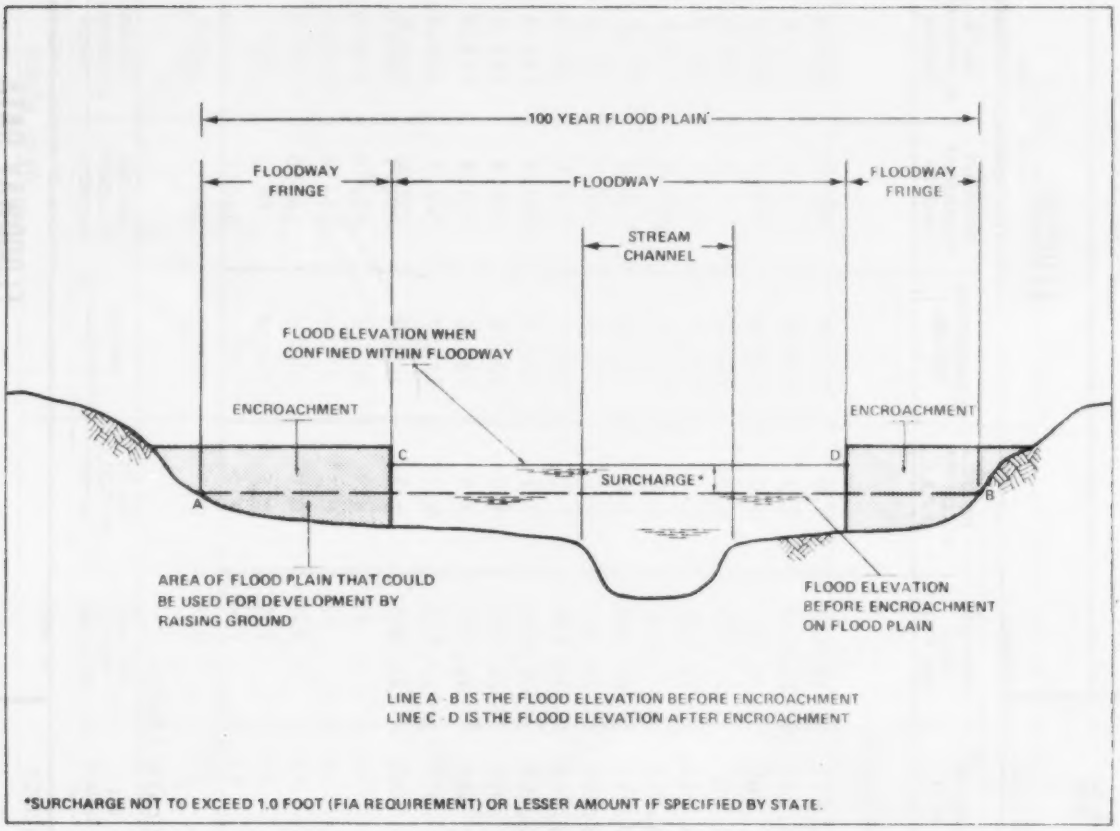
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

FLOODWAY DATA

SUSQUEHANNA RIVER

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Borough of Towanda.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Borough of Towanda are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Borough of Towanda was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Susquehanna River							
Reach 1	01	-6.3	-1.7	+4.4	065	A13	Varies
Reach 2	01	-6.0	-1.6	+4.3	060	A12	Varies
Tributary A							
Reach 1	01	-0.9	-0.2	+0.5	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

FLOOD INSURANCE ZONE DATA

SUSQUEHANNA RIVER AND TRIBUTARY A

Zones A2, A12, A13:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the Borough of Towanda.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Borough of Towanda is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A storm drainage study for Towanda has been prepared which indicates that local flood problems are due to the non-existent or inadequate municipal drainage facilities (Reference 2). The Flood Insurance Studies of the Townships of Towanda and North Towanda are currently being prepared (References 9 and 10). The results of those studies will be in exact agreement with the results of this study. No other studies relating to flood problems in the borough are known to exist.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

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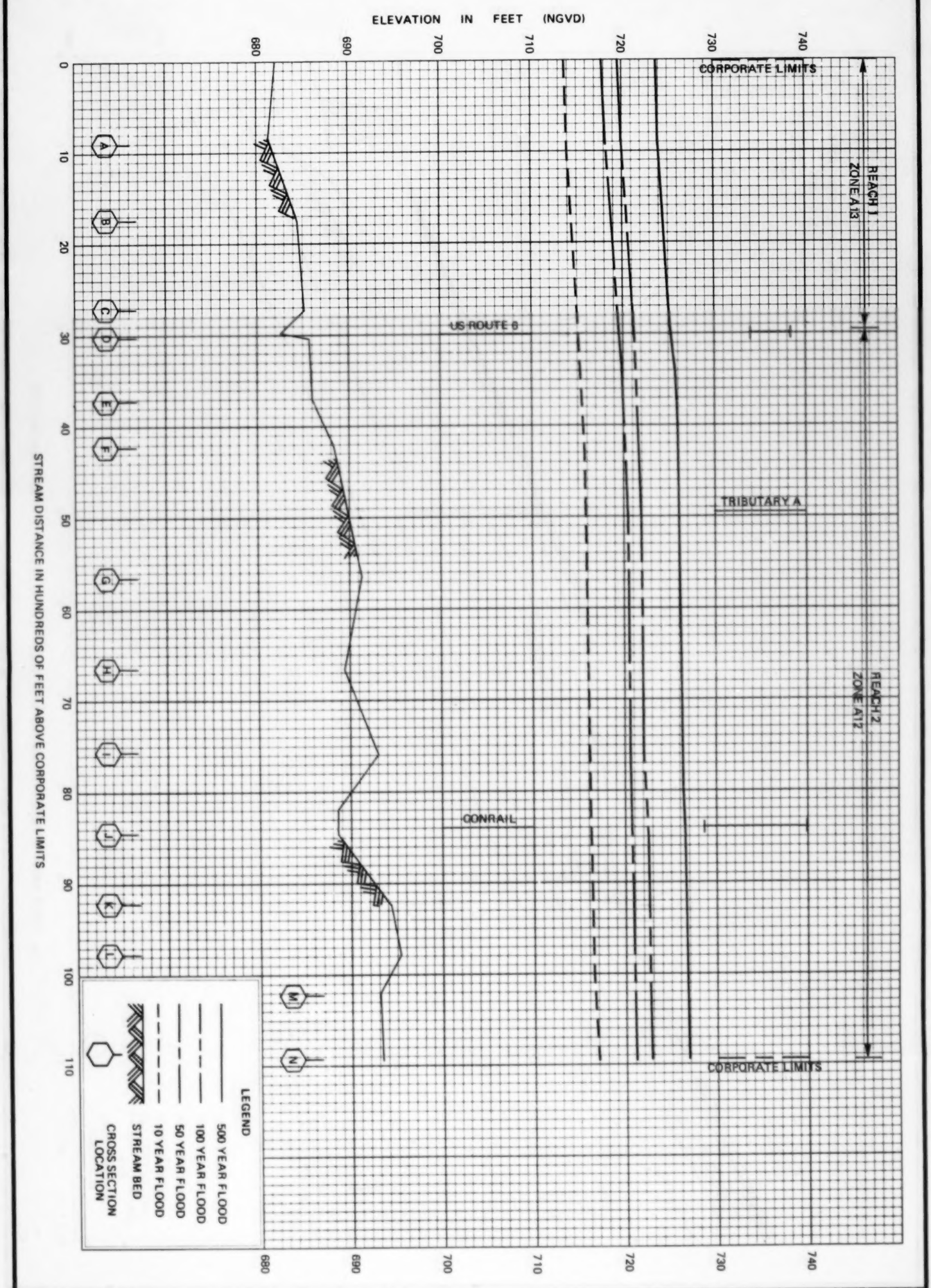


FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

FLOOD PROFILES

SUSQUEHANNA RIVER

01P

REACH 1
ZONE A2

BACKWATER FROM SUSQUEHANNA RIVER
ZONE A12

CONFLUENCE WITH SUSQUEHANNA RIVER
HEADWALL
CONRAIL
RIVER STREET
MAIN STREET
US ROUTE 6 & 220
3RD STREET
HEADWALL

MANHOLE
MANHOLE
CULVERT

THE 10-, 50-, AND 500-YEAR FLOOD PROFILES ARE TOO CLOSE TO THE 100-YEAR ELEVATION TO BE SHOWN SEPARATELY

ELEVATION IN FEET (NGVD)

770
760
750
740
730
720
710
700
690

0 1 2 3 4 5 6 7 8 9 10 11 12 13

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH SUSQUEHANNA RIVER

LEGEND
- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- CULVERT SYSTEM
- PRIMARY CHANNEL BED
- CROSS SECTION LOCATION

FLOOD PROFILES

TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

02P

REACH 1
ZONE A2

HEADWALL

4TH STREET

HEADWALL

HEADWALL

THE 50-YEAR FLOOD PROFILE IS TOO CLOSE TO THE 100-YEAR ELEVATION TO BE SHOWN SEPARATELY.

THE 50-YEAR FLOOD PROFILE IS TOO CLOSE TO THE 100-YEAR ELEVATION TO BE SHOWN SEPARATELY

ELEVATION IN FEET (NGVD)

830
820
810
800
790
780
770
760
750

13 14 15 16 17 18 19 20 21 22 23 24 25 26

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH SUSQUEHANNA RIVER

C D E

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- CULVERT SYSTEM
- PRIMARY CHANNEL BED
- CROSS SECTION LOCATION

FLOOD PROFILES

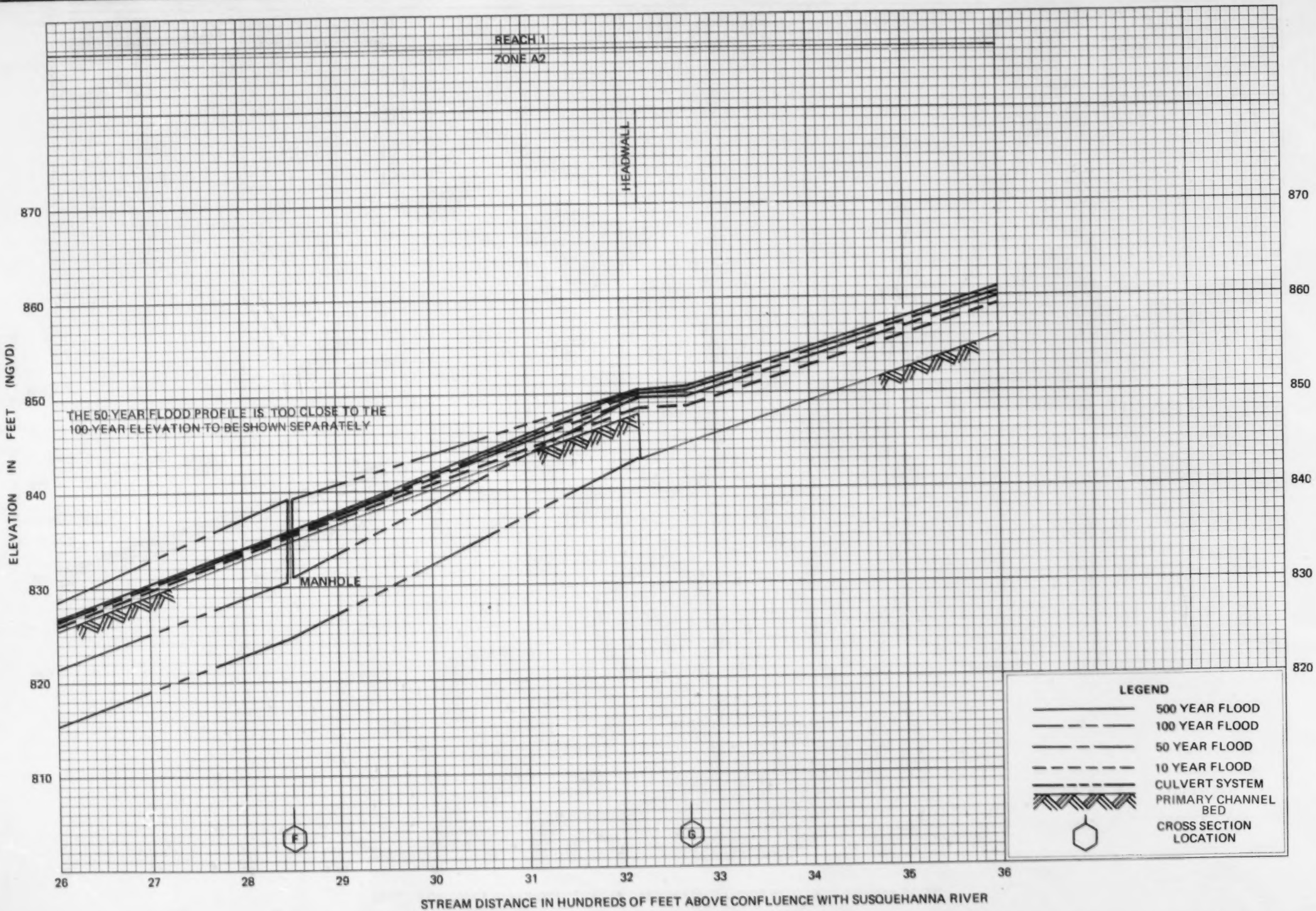
TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

BOROUGH OF TOWANDA, PA
(BRADFORD CO.)

03P

NUMBER - 420178



FLOOD PROFILES

TRIBUTARY A

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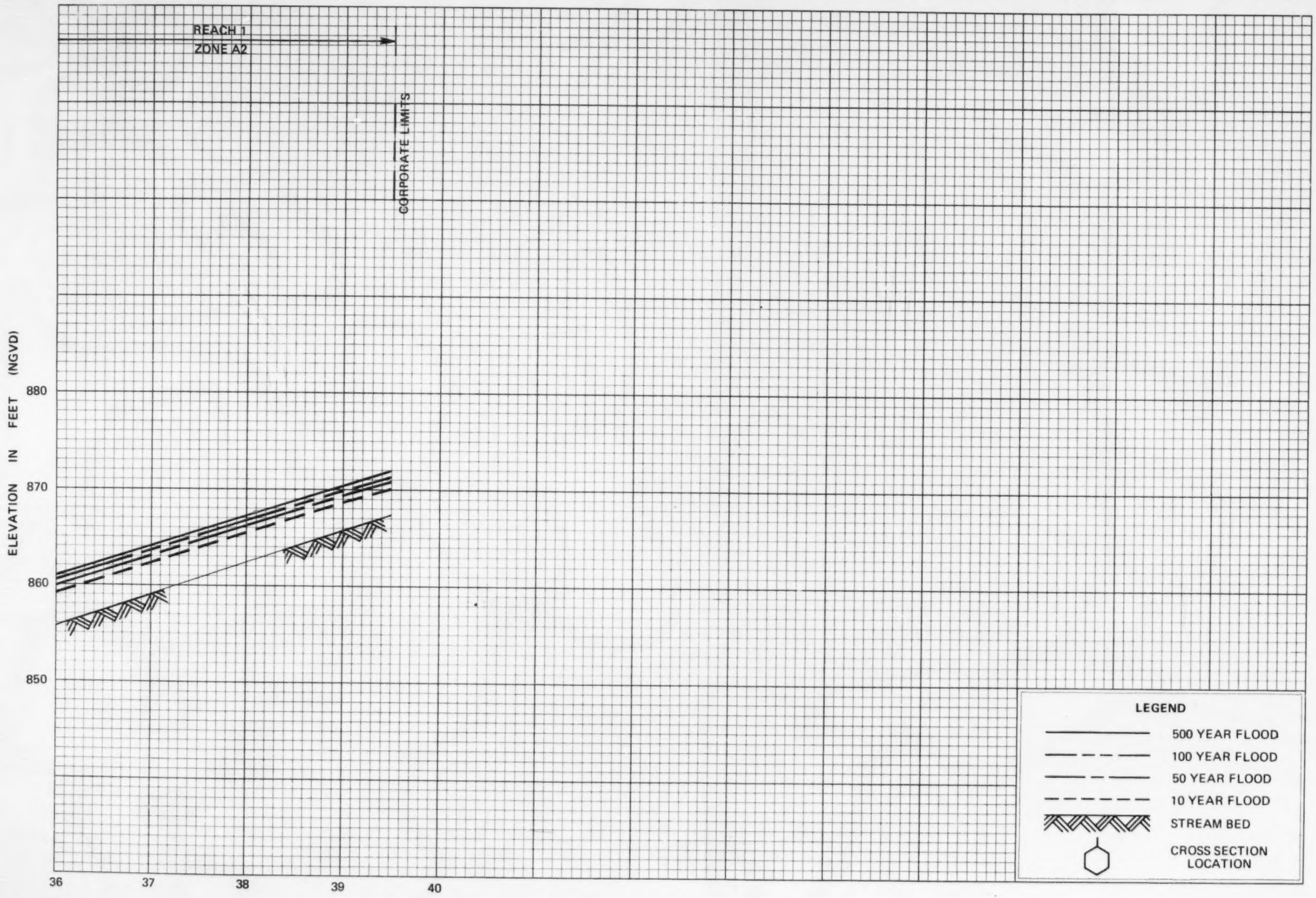

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FLOOD PROFILES

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COMMUNITY NUMBER - 420178